

REVIEW - QUADRATIC FUNCTIONS

KEY

BASIC CONCEPT QUESTIONS

1. Name and write the equation of the two forms we use to represent quadratic functions.

Standard Form: $y = ax^2 + bx + c$

Vertex Form: $y = a(x-h)^2 + k$

2. Circle all of the following functions that are quadratic functions.

$y = -\frac{1}{2}x + 3$

$y = 8x^2 - 7$

$y = x^2$

$y = 9x^3 - 5x^2 + 2$

$y = -6(x+1)^2$

3. Given an equation, how do you know if a parabola is concave up or concave down?

If a is positive \rightarrow concave up

a negative \rightarrow concave down

4. Given an equation, how do you know if the parabola will be skinnier or wider than the parent function?

$|a| > 1 \rightarrow$ skinnier

* negatives don't matter!

$|a| < 1 \rightarrow$ wider

Use absolute value!

5. What do c and k change about the graph?

Shift up + down (vertical translation)

6. What does the h value change about the graph?

Shift left and right (horizontal translation)

* opposite sign as what you see in $()$ left + right -

7. What is the vertex?

Max or min value, turning point. Always on axis of symmetry.

8. How do you find the vertex of a quadratic function

a. From Standard Form?

b. From Vertex Form?

$x = -\frac{b}{2a}$ plug back in

(h, k)

9. From the equation, how can you tell if the vertex will be a maximum or a minimum?

$a > 0 \rightarrow$ Min

$a < 0 \rightarrow$ Max

10. What is the axis of symmetry? $x =$

Line through vertex down middle of parabola (that cuts it into 2 symmetric halves)

11. How do you find the axis of symmetry? $-x$ value of vertex

a. From Standard Form?

b. From Vertex Form?

$x = -\frac{b}{2a}$

$x = h$

12. How do you find the y -intercept of any function?

plug in $x = 0$

13. List all the other names for "solutions" of a quadratic function.

roots, zeros, x -intercepts

14. What do you need to be sure is true about your function before you start finding solutions?

that it $= 0$

15. What are the 3 methods for finding solutions of a quadratic function?

① Graphing (+ find x -intercepts)

② Factoring + zero product property

③ Quadratic Formula

16. State the quadratic formula.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

17. What is the discriminant?

$$b^2 - 4ac$$

18. What does the value of the discriminant tell you about your function if it is

a. positive

b. negative

c. zero

2 real solutions

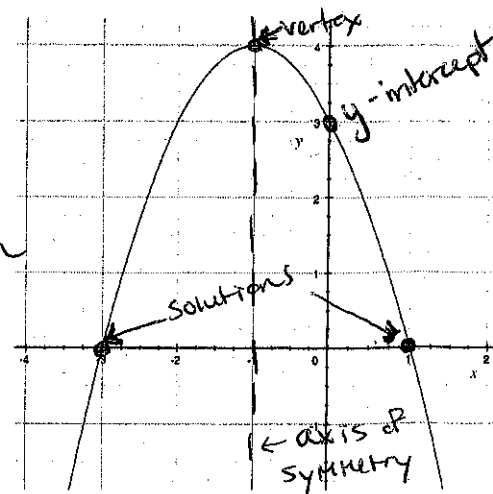
2 complex solutions

1 real solution

19. Label all of the key features (vertex, axis of symmetry, solutions, y -intercept) on the graph to the right.

20. Give either definition for i .

$$i = \sqrt{-1} \quad i^2 = -1$$



PRACTICE PROBLEMS

21. Consider the function $y = 4x^2 - 24x - 7$

A. Find the y-intercept $(0, -7)$

B. Will the vertex be a maximum or a minimum? Why? Min b/c a is positive

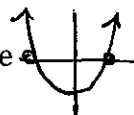
C. Find the vertex. $a=4$ $b=-24$ $x = \frac{-b}{2a} = \frac{24}{8} = 3$ $4(3)^2 - 24(3) - 7 = -43$ $(3, -43)$

22. Sketch the graph of a quadratic function that has

a. exactly one positive solution

b. exactly two solutions, one positive and one negative

c. no real solutions

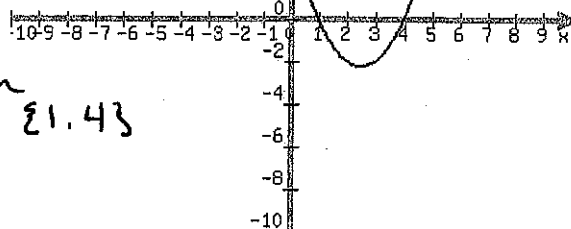


23. Find the solutions of $\frac{6x^2}{6} = \frac{150}{6}$

$$\sqrt{x^2} = \sqrt{25} \quad x = \pm 5$$

24. State the solution(s) of the quadratic function based on the graph to the right.

$$x = 1, 4 \quad \text{Solution set } \{1, 4\}$$



25. Find the solutions of $9x^2 = 4x$ by factoring. SHOW ALL WORK.

$$9x^2 - 4x = 0$$

$$x(9x - 4) = 0$$

$$9x - 4 = 0$$

$$\frac{9x}{9} = \frac{4}{9}$$

$$x = 0$$

$$x = \frac{4}{9}$$

26. Find the solutions of $y = x^2 - 6x + 7$ by factoring. SHOW ALL WORK.

$$(x - 7)(x + 1) = 0$$

$$x - 7 = 0$$

$$x = 7$$

$$x + 1 = 0$$

$$x = -1$$

27. Find the solutions of $y = -2x^2 + 6x + 5$ using the quadratic formula. SHOW WORK.

$$a = -2 \quad b = 6 \quad c = 5$$

$$b^2 - 4ac = 6^2 - 4(-2)(5) = 76$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{76}}{-4}$$

$$\approx -0.68$$

$$\approx 3.68$$

28. Find the solutions of $f(x) = 3x^2 + 2x + 7$ using the quadratic formula. SHOW WORK.

$$a = 3 \quad b = 2 \quad c = 7$$

$$b^2 - 4ac = 2^2 - 4(3)(7) = -80$$

$$x = \frac{-2 \pm \sqrt{-80}}{6}$$

$$= \frac{-2 \pm i\sqrt{80}}{6}$$

29. Find the solutions of $x^2 + 7x = -10$ using the method of your choice. SHOW WORK.

$$x^2 + 7x + 10 = 0$$

$$(x+5)(x+2) = 0$$

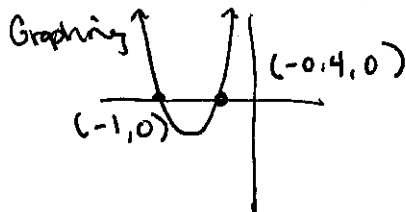
$$x+5=0$$

$$x = -5$$

$$x+2=0$$

$$x = -2$$

30. Find the solutions of $y = 5x^2 + 7x + 2$ using the method of your choice. SHOW ALL WORK.



Quad Form

$$a=5 \quad b=7 \quad c=2$$

$$b^2 - 4ac = 7^2 - 4(5)(2) = 9$$

$$x = \frac{-7 \pm \sqrt{9}}{2(5)} = \frac{-7 \pm 3}{10} \rightarrow \frac{-7+3}{10} = -0.4$$

$$\frac{-7-3}{10} = -1$$

31. Write the equation of the quadratic function whose vertex is (4,5) through the point (-2,20).

$$y = a(x-h)^2 + k$$

$$20 = a(-2-4)^2 + 5$$

$$20 = a(-6)^2 + 5$$

$$\frac{15}{36} = \frac{36a}{36} \quad a = \frac{15}{36} = \frac{5}{12}$$

$$y = \frac{5}{12}(x-4)^2 + 5$$

32. Write the equation of the quadratic function whose solutions/roots are -4 and 5.

$$x = -4 \Rightarrow x+4=0$$

$$x = 5 \Rightarrow x-5=0$$

$$(x+4)(x-5) = x^2 - x - 20$$

33. Write the equation of a quadratic function that is concave up, skinnier than the parent function, and whose vertex is at (2,12)

$$y = 3(x-2)^2 + 12$$

any # > 1

34. Write the equation of a quadratic function that is concave down, wider than the parent function and is shifted down 5 units.

$$y = -\frac{1}{2}x^2 - 5$$

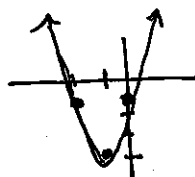
any # whose absolute value is < 1

35. Consider the function $f(x) = 2(x-5)^2 + 3$. Write the equation of a new function, $g(x)$, that takes $f(x)$ and shifts it 4 units left and 9 units down.

$$g(x) = 2(x-1)^2 - 6$$

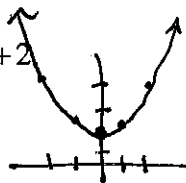
36. Graph the function $y = 3(x+1)^2 - 4$.

$$\text{vertex} = (h, k) = (-1, -4)$$



37. Graph the function $y = \frac{1}{3}x^2 + 2$

$$\text{vertex} = (0, 2)$$



38. An object in the air is given by the equation $h(t) = -16t^2 + 4t + 8$.

vertex

a. Find the time when the object reaches its maximum height. $t = \frac{-b}{2a} = \frac{-4}{2(-16)} = 0.125 \text{ sec}$

b. Find the maximum height of the object. $h(0.125) = -16(0.125)^2 + 4(0.125) + 8 = 8.25 \text{ ft}$

c. How high is the object after 3 seconds in the air?

$h(3) = -124 \rightarrow$ already landed! $h=0 \text{ ft}$

solution
x-intercept

d. When will the object hit the ground?

after 0.843 sec

39. If $f(x) = x^2$, find and simplify $f(3i)$.

$$f(3i) = (3i)^2 = 9i^2 = 9(-1) = -9$$

40. Simplify $(3+7i) - (9+4i)$

$$3+7i - 9 - 4i = -6 + 3i$$

41. Simplify $(3+7i)(9+4i)$

$$\begin{array}{r|rr} 3 & 27 & 12i \\ 7i & 28i & 28i^2 \end{array} \quad 27 + 12i + 28i + 28i^2 = 27 + 40i - 28 = -1 + 40i$$

42. Simplify $\sqrt{-36}$

$$= 6i$$

43. Solve $x^2 = -81$. (Make sure you find BOTH solutions, not just one)

$$x = \pm 9i \quad \text{or} \quad \{9i, -9i\}$$

44. What is the value of x in the equation $\sqrt{x+4} = 2i$?

$$x+4 = (2i)^2 = 4i^2 = 4(-1) = -4$$

$$x+4 = -4 \quad x = -8$$

45. What is the greatest common factor of $24a^3b^2c$ and $10ab^2c^3$?

$$2ab^2c$$

46. If $5x$ is one factor of $10x^2 - 15x$, what is the other factor?

$$5x(2x-3)$$

$$2x-3$$

47. Factor $x^2 - 81$.

$$(x-9)(x+9)$$

48. Factor $3x^2 - 12$ completely.

$$3(x-4) = 3(x-2)(x+2)$$

49. What is a common factor of $x^2 + 3x - 10$ and $x^2 + 6x + 5$?

$$(x+5)(x-2)$$

$$(x+5)(x+1)$$

$$x+5$$

50. Given the table, find the equation of the quadratic function.

x	y
1	4
2	1
3	0
4	1
5	4

$$y = 1(x-3)^2 + 0$$

$$y = (x-3)^2$$

vertex

+1
+1